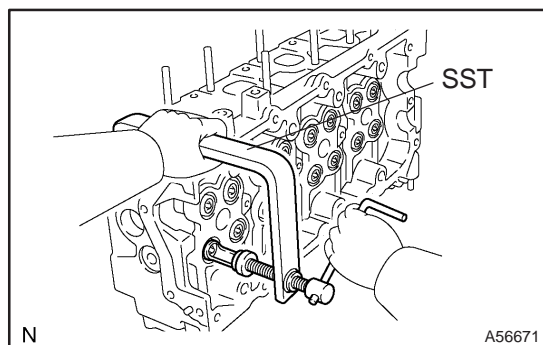


# OVERHAUL

## 1. REMOVE VALVE LIFTER

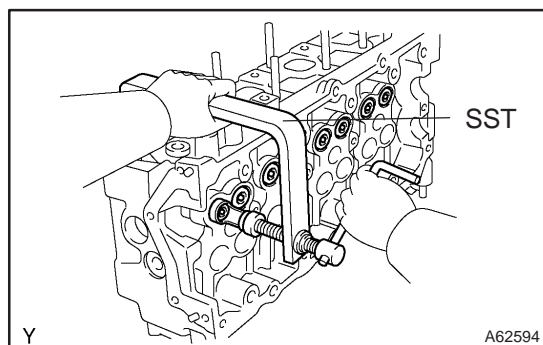
### HINT:

Arrange the valve lifters in the correct order.



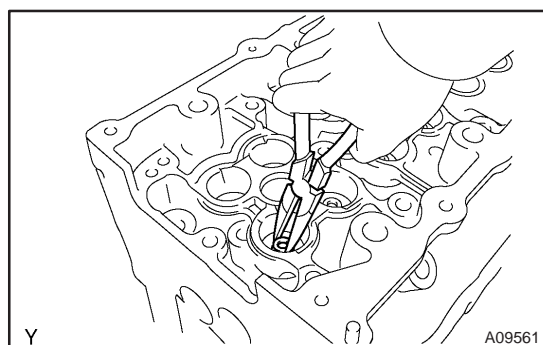
## 2. REMOVE INTAKE VALVE

- (a) Using SST, compress the valve spring and remove the 2 keepers.  
SST 09202-70020 (09202-00010)
- (b) Remove the spring retainer, valve spring and valve.



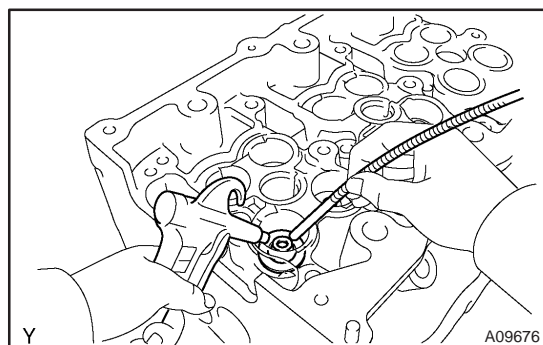
## 3. REMOVE EXHAUST VALVE

- (a) Using SST, compress the valve spring and remove the 2 keepers.  
SST 09202-70020 (09202-00010)
- (b) Remove the spring retainer, valve spring and valve.



## 4. REMOVE VALVE STEM OIL O SEAL OR RING

- (a) Using needle-nose pliers, remove the oil seal.

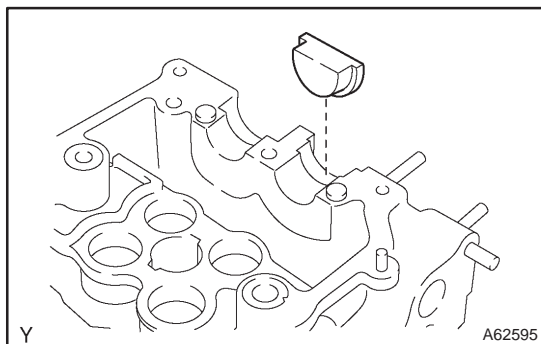


## 5. REMOVE VALVE SPRING SEAT PLATE WASHER

- (a) Using compressed air and a magnetic finger, remove the spring seat by blowing air.

### HINT:

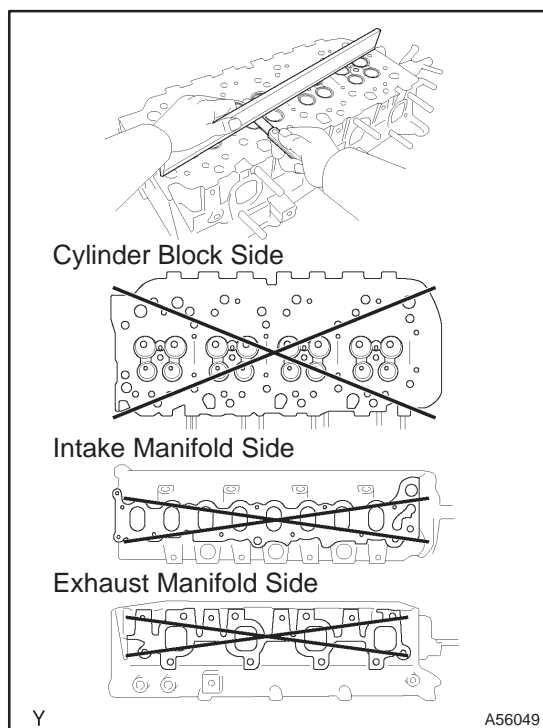
Arrange the valves, valve springs, spring seats and spring retainers in the correct order.



## 6. REMOVE SEMICIRCULAR PLUG

## 7. REMOVE W/HEAD TAPER SCREW PLUG NO.1

- (a) Using a hexagon wrench (6mm), remove the 3 plugs.  
SST 99999-70037

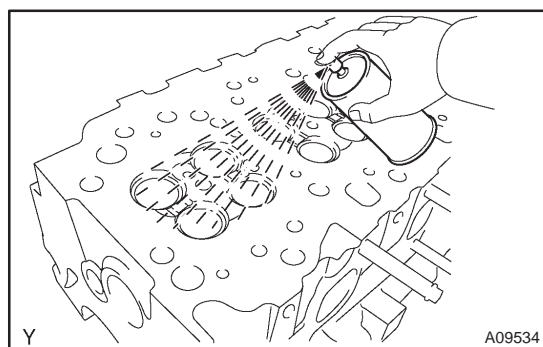


## 8. INSPECT CYLINDER HEAD FOR FLATNESS

- (a) Using a precision straight edge and feeler gauge, measure the surfaces contacting the cylinder block and the manifolds for warpage.

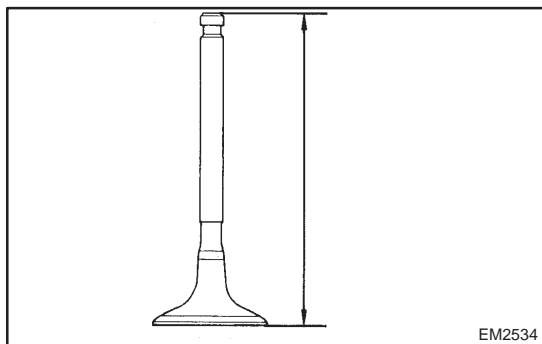
### Maximum warpage:

Cylinder block side	0.08mm(0.0031in.)
Intake manifold side	0.20mm(0.0079in.)
Exhaust manifold side	0.20mm(0.0079in.)



## 9. INSPECT CYLINDER HEAD FOR CRACKS

- (a) Using dye penetrant, check the intake ports, exhaust ports and cylinder block contact surface for cracks.

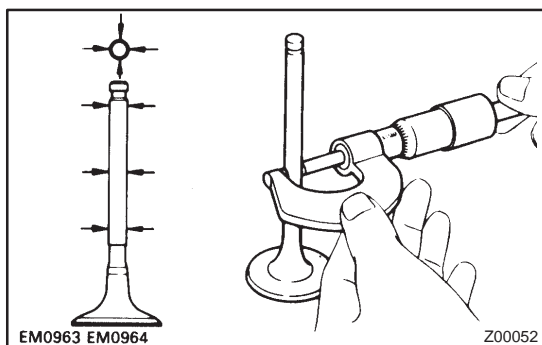


## 10. INSPECT INTAKE VALVE

- (a) Check the valve overall length.

**Standard overall length: 102.53 mm (4.0366 in.)**

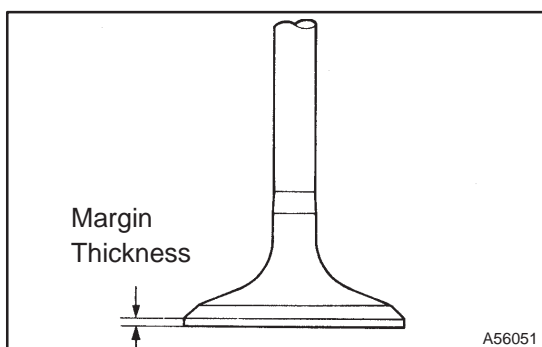
**Minimum overall length: 102.10 mm (4.0197 in.)**



- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

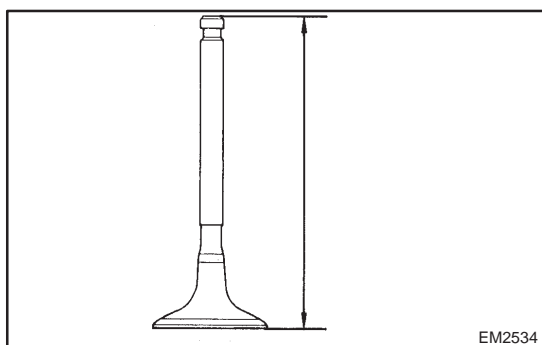
**5.970 – 5.985 mm (0.2350 – 0.2356 in.)**



- (c) Check the valve head margin thickness.

**Standard margin thickness: 0.9 mm (0.035 in.)**

**Minimum margin thickness: 0.6 mm (0.0247 in.)**

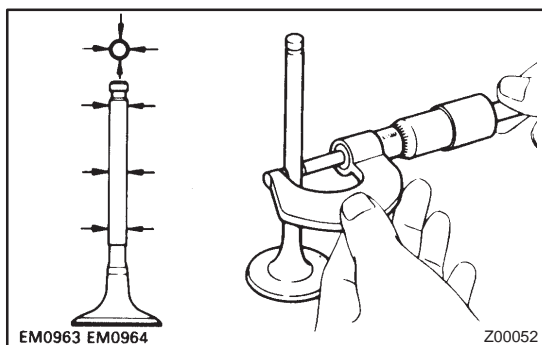


## 11. INSPECT EXHAUST VALVE

- (a) Check the valve overall length.

**Standard overall length: 101.97 mm (4.0146 in.)**

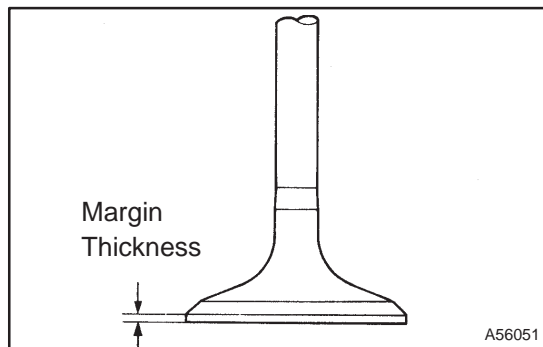
**Minimum overall length: 101.55 mm (3.9980 in.)**



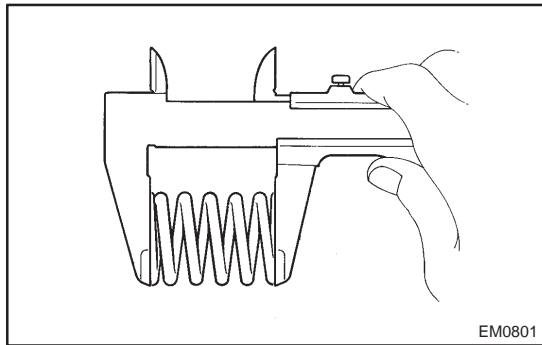
- (b) Using a micrometer, measure the diameter of the valve stem.

**Valve stem diameter:**

**5.960 – 5.975 mm (0.2346 – 0.2352 in.)**

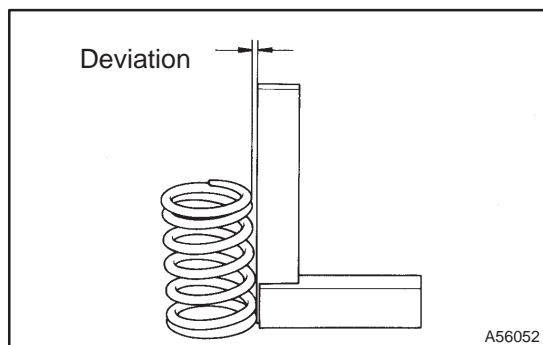


- (c) Check the valve head margin thickness.  
**Standard margin thickness: 0.9 mm (0.035 in.)**  
**Minimum margin thickness: 0.6 mm (0.024 in.)**

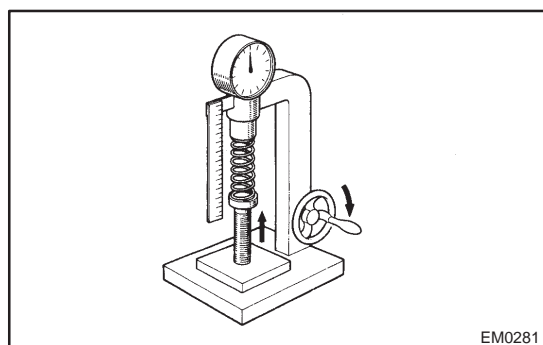


## 12. INSPECT INNER COMPRESSION SPRING

- (a) Using vernier calipers, measure the free length of the valve spring.  
**Free length: 40.45 mm (1.5925 in.)**

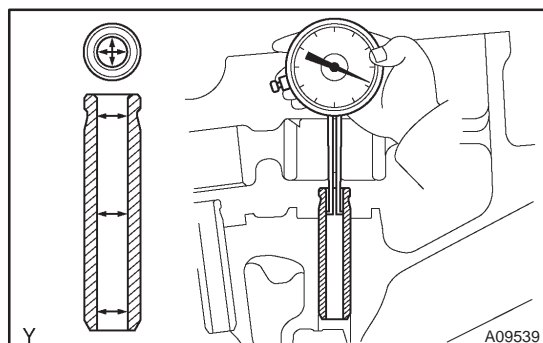


- (b) Using a steel square, measure the deviation of the valve spring.  
**Maximum deviation: 2.0 mm (0.079 in.)**



- (c) Using a spring tester, measure the tension of the valve spring at the specified installed length.  
**Installed tension:**  
**177 – 195 N (18.0 – 19.9 kgf, 39.7 – 44.1 lbf) at 31.1 mm (1.224 in.)**

If the installed tension is not as specified, replace the valve spring.



## 13. INSPECT VALVE GUIDE BUSHING OIL CLEARANCE

- (a) using a caliper gauge, measure the inside diameter of the guide bushing.  
**Bushing inside diameter:**  
**6.010 – 6.030 mm (0.2366 – 0.2374 in.)**

- (b) Subtract the valve stem diameter measurement from the guide bushing inside diameter measurement.

**Standard oil clearance:**

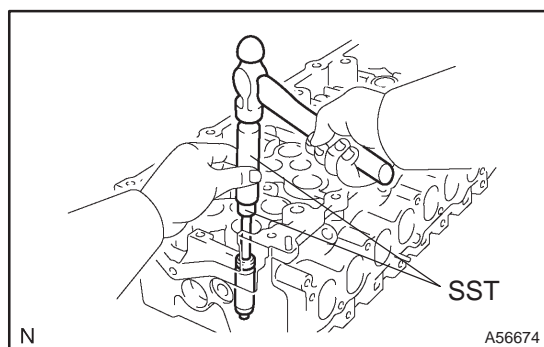
Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
Exhaust	0.035 – 0.070 mm (0.0014 – 0.0028 in.)

**Maximum oil clearance:**

Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

**14. REMOVE INTAKE VALVE GUIDE BUSH**

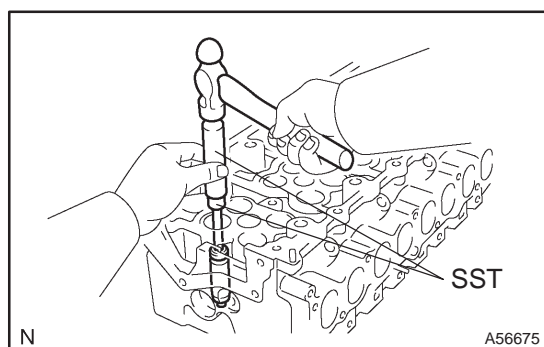
- (a) Heat the cylinder head to 80 – 100°C (176 – 212°F).



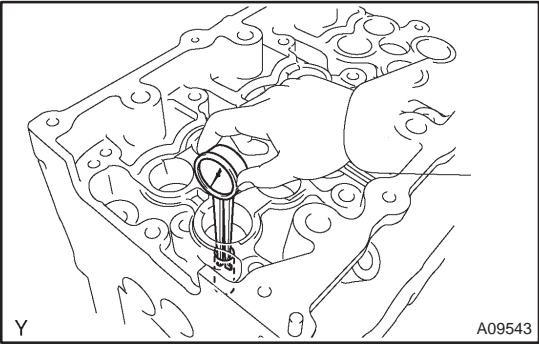
- (b) Using SST and a hammer, tap out the guide bushing.  
 SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)

**15. REMOVE EXHAUST VALVE GUIDE BUSH**

- (a) Heat the cylinder head to 80 – 100°C (176 – 212°F).



- (b) Using SST and a hammer, tap out the guide bushing.  
 SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)



**16. INSTALL INTAKE VALVE GUIDE BUSH**

- (a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

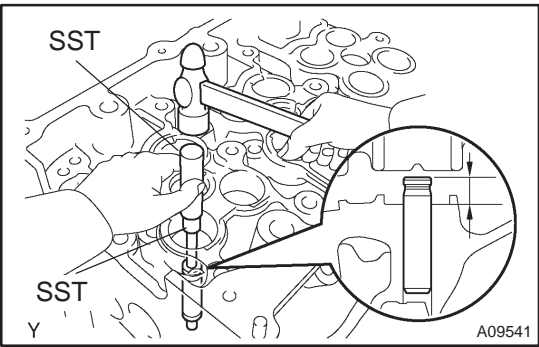
**Diameter: 10.985 – 11.006 mm (0.4325 – 0.4333 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the dimension of 11.035 – 11.056 mm (0.4344 – 0.4353 in.).

**HINT:**

Bushing size	Bushing bore diameter mm (in.)
Use STD	10.985 – 11.006 (0.4325 – 0.4333)
Use O/S 0.05	11.035 – 11.056 (0.4344 – 0.4353)

- (b) Heat the cylinder head to 80 – 100°C. (176 – 212°F)

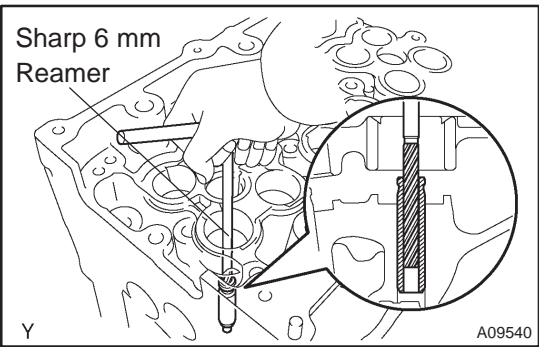


- (c) Using SST and a hammer, top in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01060), 09950-70010 (09951-07100)

**Protrusion height:**

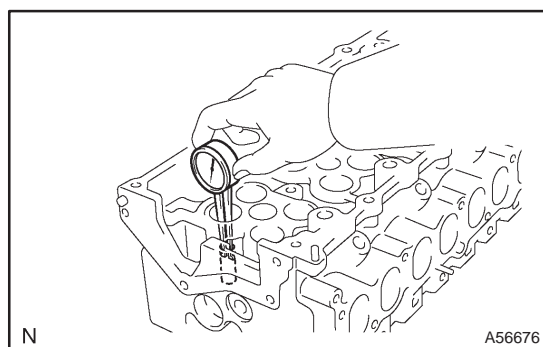
**10.05 – 10.45 mm (0.3957 – 0.4114 in.)**



- (d) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

**Standard oil clearance:**

**0.025 – 0.060 mm (0.0010 – 0.0024 in.)**



## 17. INSTALL EXHAUST VALVE GUIDE BUSH

- (a) Using a caliper gauge, measure the bushing bore diameter of the cylinder head.

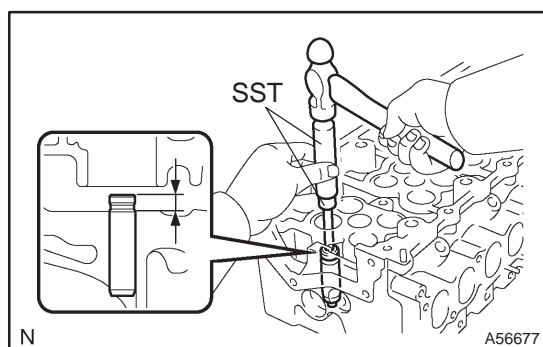
**Diameter: 10.985 – 11.006 mm (0.4325 – 0.4333 in.)**

If the bushing bore diameter of the cylinder head is greater than 11.006 mm (0.4333 in.), machine the bushing bore to the dimension of 11.035 – 11.056 mm (0.4344 – 0.4353 in.).

**HINT:**

Bushing size	Bushing bore diameter mm (in.)
Use STD	10.985 – 11.006 (0.4325 – 0.4333)
Use O/S 0.05	11.035 – 11.056 (0.4344 – 0.4353)

- (b) Heat the cylinder head to 80 – 100°C. (176 – 212°F)

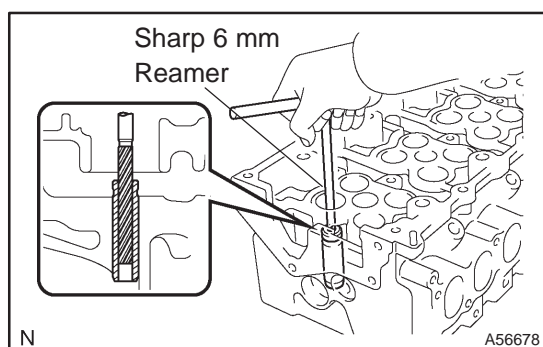


- (c) Using SST and a hammer, tap in a new guide bushing to the specified protrusion height.

SST 09201-10000 (09201-01060), 09950-70010  
(09951-07100)

**Protrusion height:**

**9.65 – 10.05 mm (0.3799 – 0.3957 in.)**



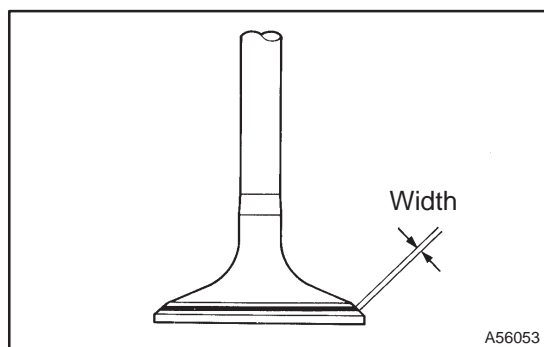
- (d) Using a sharp 6 mm reamer, ream the guide bushing to obtain the standard specified clearance between the guide bushing and valve stem.

**Standard oil clearance:**

**0.035 – 0.070 mm (0.0014 – 0.0028 in.)**

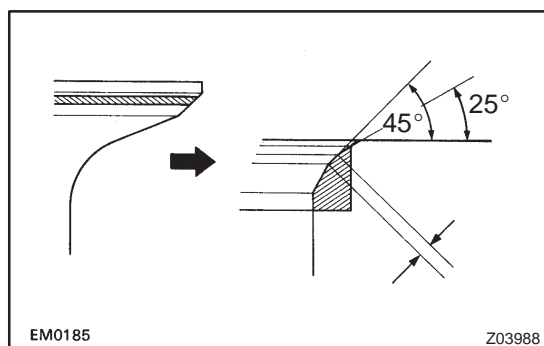
## 18. INSPECT VALVE SEATS

- (a) Apply a light coat of prussian blue (or white lead) to the valve face.
- (b) Lightly press the valve against the seat.



- (c) Check the valve face and seat according to the following procedure.
- (1) If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
  - (2) If blue appears 360° around the valve seat, the guide and face are concentric. If not, resurface the seat.
  - (3) Check that the seat contact is in the middle of the valve face with the following width.

Intake	1.2 – 1.6 mm (0.047 – 0.063 in.)
Exhaust	1.6 – 2.0 mm (0.063 – 0.079 in.)

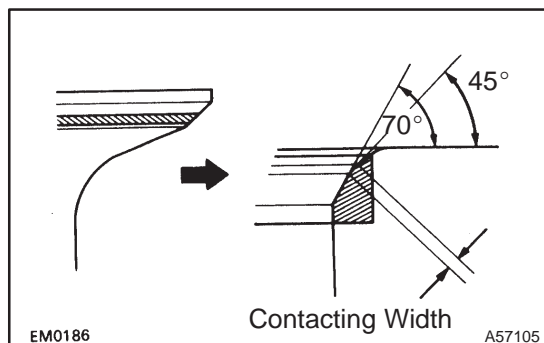


## 19. REPAIR INTAKE VALVE SEATS

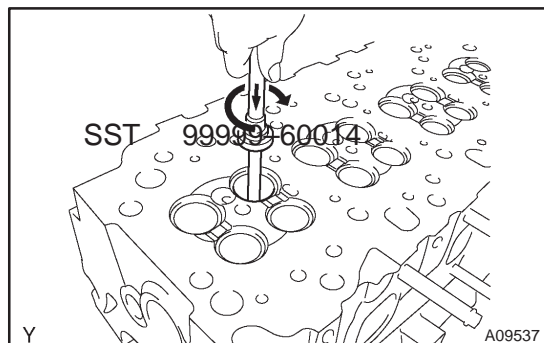
### NOTICE:

**Take off a cutter gradually to make smooth valve seats.**

- (a) If the seating is too high on the valve face, use 25° and 45° cutters to correct the seat.

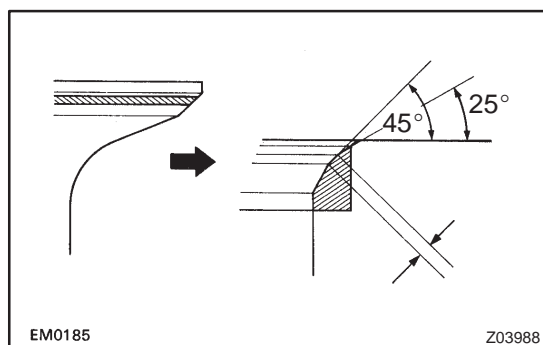


- (b) If the seating is too low on the valve face, use 70° and 45° cutters to correct the seat.



- (c) Hand-lap the valve and valve seat with an abrasive compound.
- (d) Check the valve seating position.



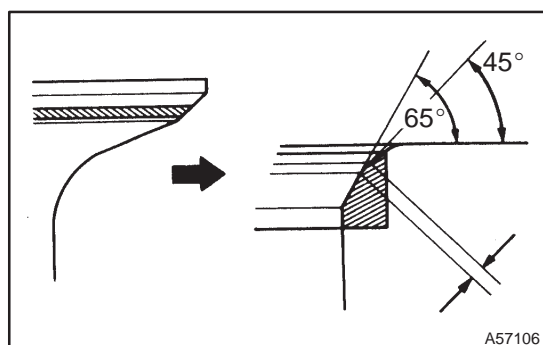


## 20. REPAIR EXHAUST VALVE SEATS

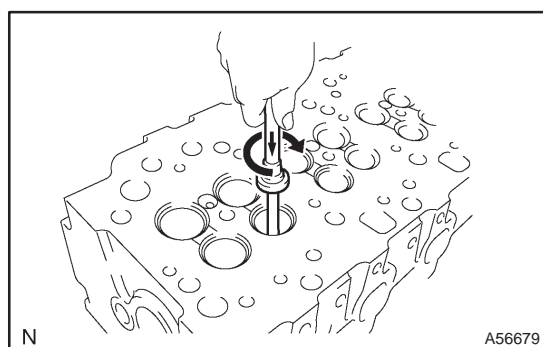
### NOTICE:

**Take off a cutter gradually to make smooth valve seats.**

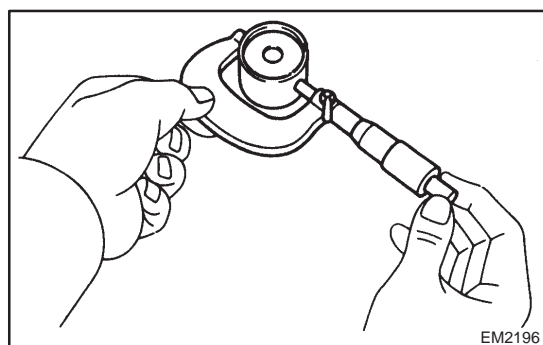
- (a) If the seating is too high on the valve face, use 25° and 45° cutters to correct the seat.



- (b) If the seating is too low on the valve face, use 65° and 45° cutters to correct the seat.



- (c) Hand-lap the valve and valve seat with an abrasive compound.  
(d) Check the valve seating position.

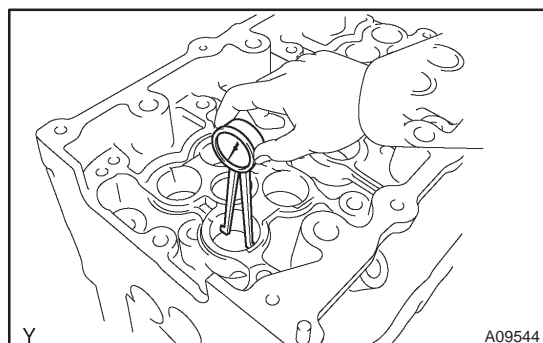


## 21. INSPECT VALVE LIFTER

- (a) Using a micrometer, measure the lifter diameter.

**Lifter diameter:**

**27.975 – 27.985 mm (1.1014 – 1.1018 in.)**



## 22. INSPECT VALVE LIFTER OIL CLEARANCE

- (a) Using a caliper gauge, measure the lifter bore diameter of the cylinder head.

**Lifter diameter:**

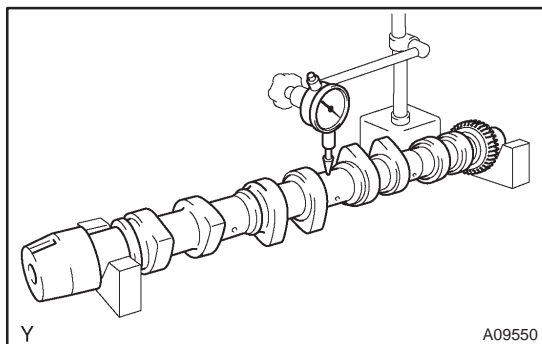
**28.010 – 28.031 mm (1.1028 – 1.1036 in.)**

- (b) Subtract the lifter diameter measurement from the lifter bore diameter measurement.

**Standard oil clearance:**

**0.025 – 0.056 mm (0.0010 – 0.0022 in.)**

**Maximum oil clearance: 0.08 mm (0.0031 in.)**



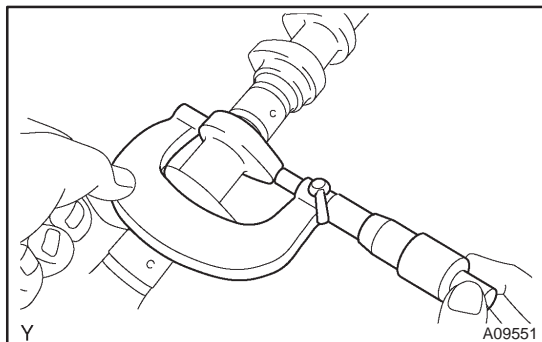
### 23. INSPECT CAMSHAFT

(a) Inspect the circle runout.

- (1) Place the camshaft on V-blocks.
- (2) Using a dial indicator, measure the circle runout at the center journal.

**Maximum circle runout: 0.06 mm (0.0024 in.)**

If the circle runout is greater than maximum, replace the camshaft.



(b) Using a micrometer, measure the cam lobe height.

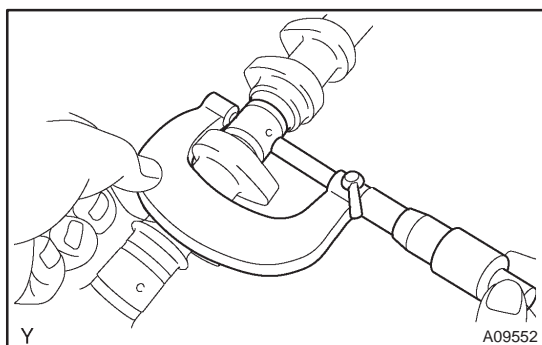
**Standard cam lobe height:**

Intake	46.57 – 46.67 mm (1.8335 – 1.8374 in.)
Exhaust	47.52 – 47.62 mm (1.8709 – 1.8748 in.)

**Minimum cam lobe height:**

Intake	46.10 mm (1.8150 in.)
Exhaust	47.05 mm (1.8524 in.)

If the cam lobe height is less than minimum, replace the camshaft.

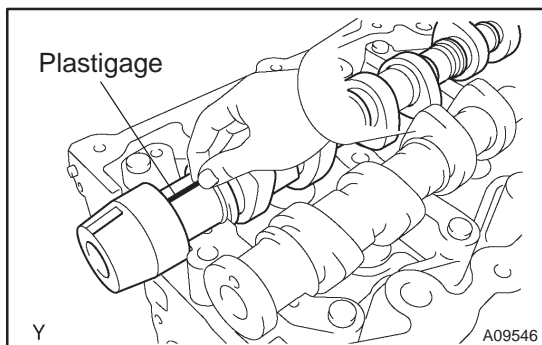


(c) Using a micrometer, measure the journal diameter.

**Journal diameter:**

**26.969 – 26.985 mm (1.0618 – 1.0624 in.)**

If the journal diameter is not as specified, check the oil clearance.



### 24. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps and camshaft carrier.

(b) Check the bearings for flaking and scoring.

If the bearings are damaged, replace the bearing caps, camshaft carrier and cylinder head as a set.

(c) Place the camshaft carrier and camshafts on the cylinder head.

(d) Lay a strip of Plastigage across each of the camshaft journals.

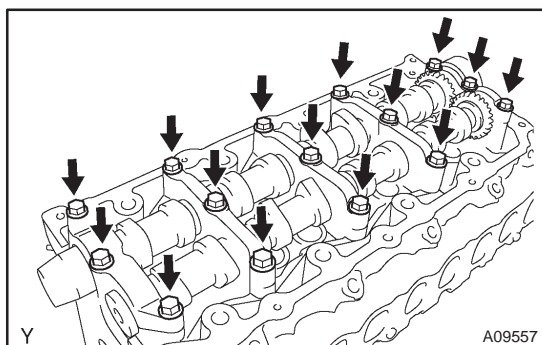
(e) Install the bearing caps.

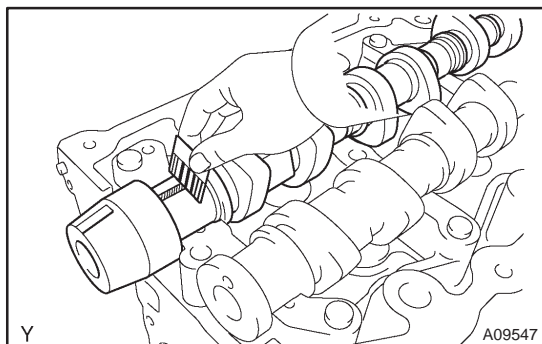
**Torque: 20 N·m (200 kgf·cm, 15 ft·lbf)**

**NOTICE:**

**Do not turn the camshaft.**

(f) Remove the bearing caps.





- (g) Measure the Plastigage at its widest point.

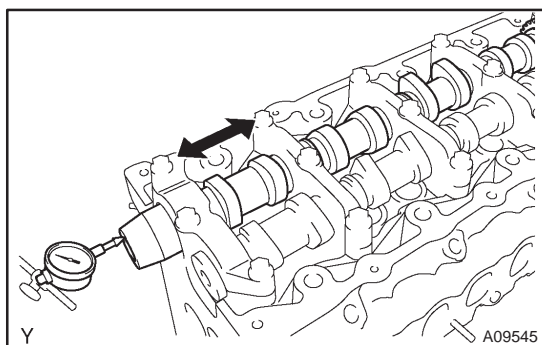
**Standard oil clearance:**

**0.025 – 0.062 mm (0.0010 – 0.0024 in.)**

**Maximum oil clearance: 0.08 mm (0.0031 in.)**

If the oil clearance is greater than maximum, replace the camshaft. If necessary, replace the bearing caps, camshaft carrier and cylinder head as a set.

- (h) Completely remove the Plastigage.



## 25. INSPECT CAMSHAFT THRUST CLEARANCE

- (a) Install the camshaft.

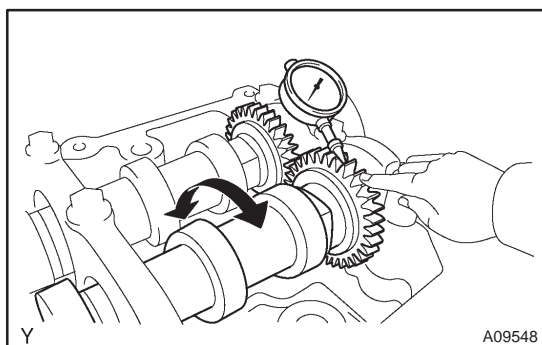
- (b) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

**Standard thrust clearance:**

**0.035 – 0.110 mm (0.0014 – 0.0043 in.)**

If the thrust clearance is not as specified, replace the camshaft.

If necessary, replace the bearing caps, camshaft carrier and cylinder head as a set.



## 26. INSPECT CAMSHAFT GEAR BACKLASH

- (a) Install the camshafts.

- (b) Using a dial indicator, measure the backlash.

**Standard backlash:**

**0.014 – 0.070 mm (0.0006 – 0.0028 in.)**

**Maximum backlash: 0.17 mm (0.0067 in.)**

If the backlash is greater than maximum, replace the camshafts.

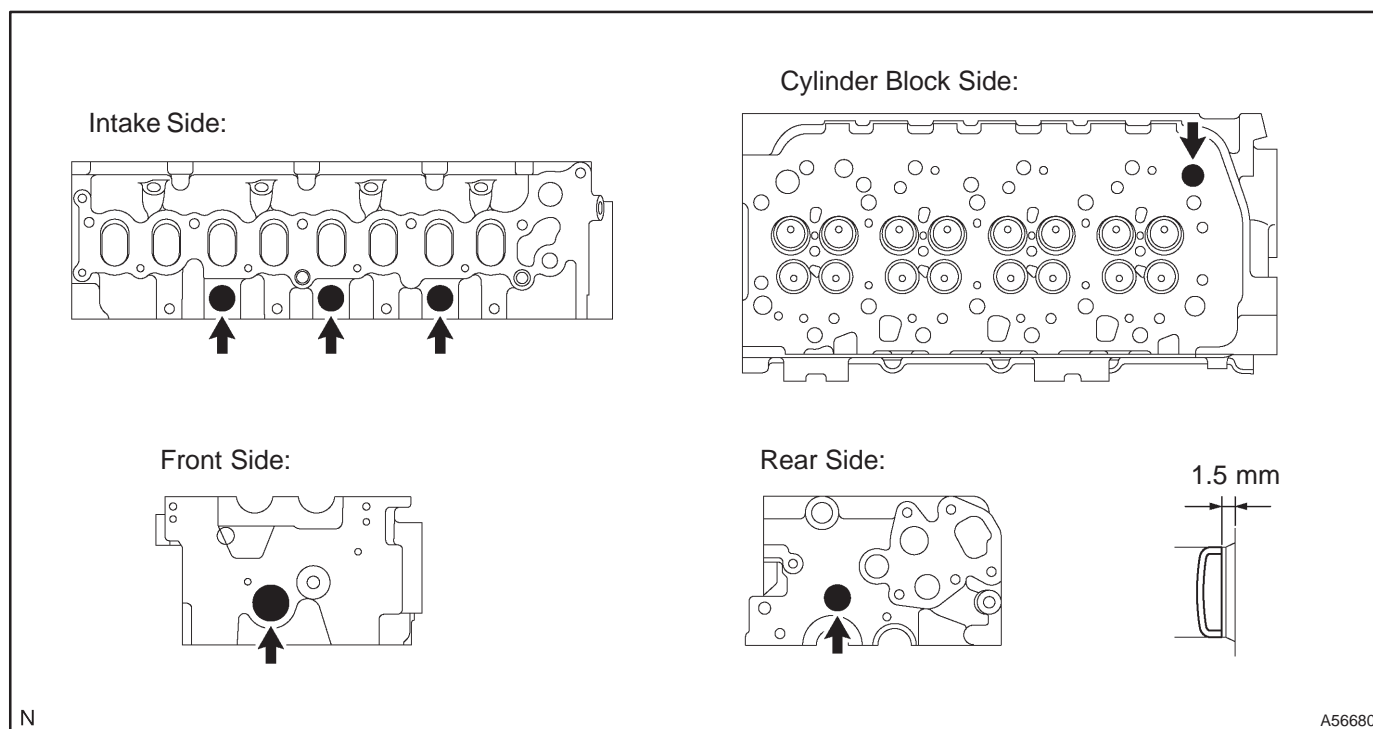
**27. INSTALL TIGHT PLUG**

- (a) Apply adhesive around tight plugs.

**Adhesive: Part No.08833 – 00070, THREE BOND 1324 or equivalent**

- (b) Using SST, tap in the tight plugs as shown in the illustration.

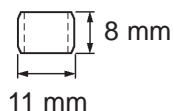
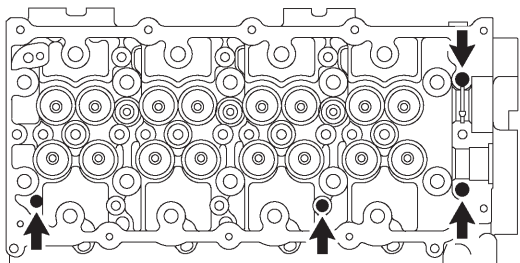
SST 09950-60010 (09951-00210), 09950-70010 (09951-07100)



**28. INSTALL RING PIN**

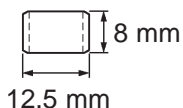
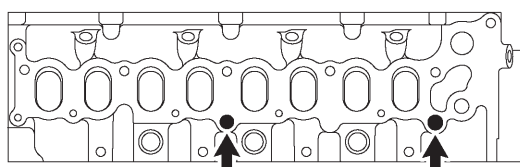
- (a) Using a plastic-faced hammer, tap in new ring pins to the specified protrusion height.

Upper Side:



Protrusion Height: 3 mm

Intake Side:



Protrusion Height: 3 mm

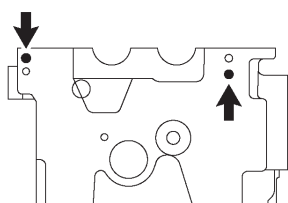
N

A56681

**29. INSTALL STRAIGHT PIN**

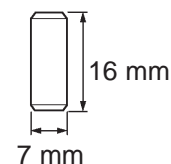
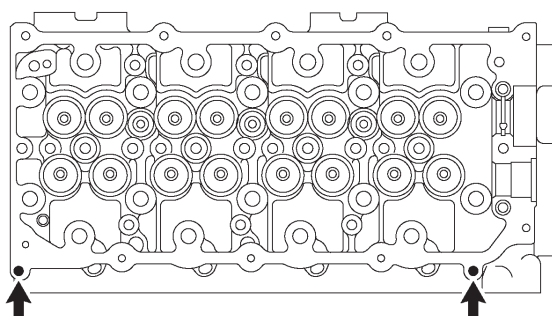
- (a) Using a plastic-faced hammer, tap in the straight pin.

Front Side:



Protrusion Height: 6 mm

Upper Side:



Protrusion Height: 11 mm

N

A56682

**30. INSTALL STUD BOLT**

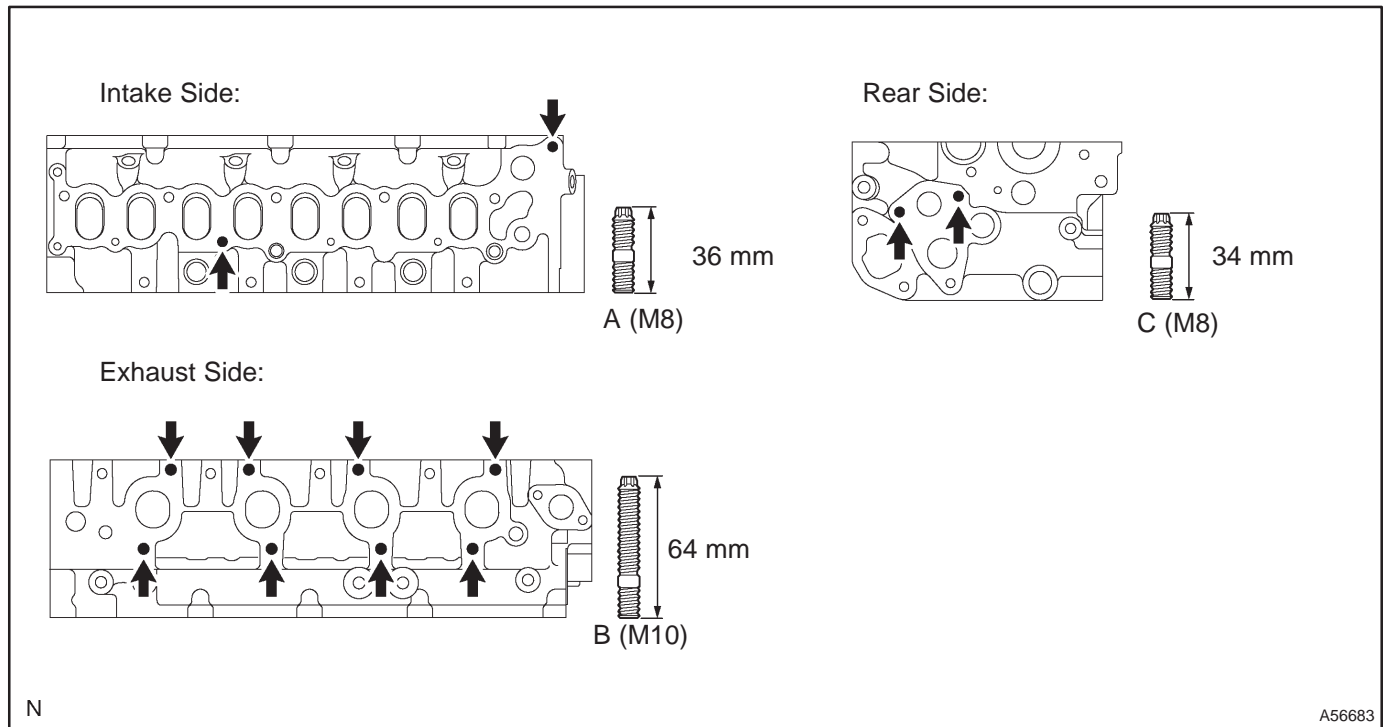
- (a) Install the stud bolts as shown in the illustration.

**Torque:**

**Bolt A 8.8N·m (90 kgf·cm, 78 in·lbf)**

**Bolt B 12N·m (120 kgf·cm, 9 ft·lbf)**

**Bolt C 8.8N·m (90 kgf·cm, 78 in·lbf)**

**31. INSTALL W/HEAD TAPER SCREW PLUG NO.1**

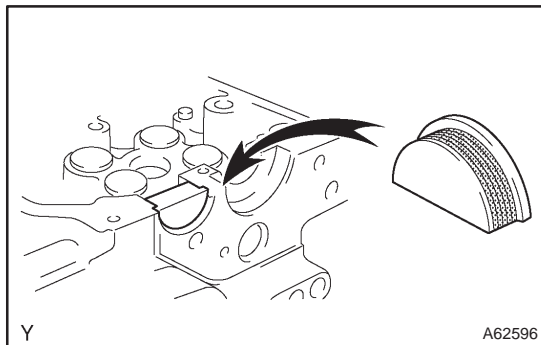
- (a) Apply adhesive to the plugs end.

**Adhesive: Part No. 08833 – 00070, THREE BOND 1324 or equivalent**

- (b) Using a hexagon wrench (6 mm), install the 3 plugs.

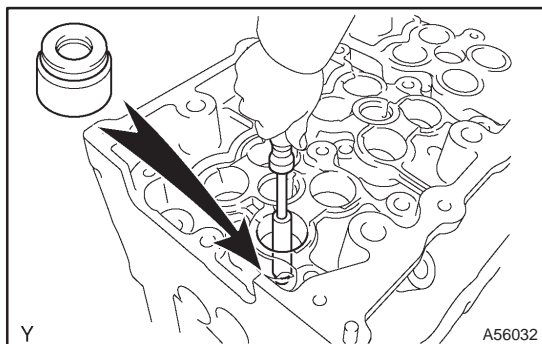
**Torque: 25N·m (255 kgf·cm, 18 ft·lbf)**

SST 99999-70037

**32. INSTALL SEMICIRCULAR PLUG**

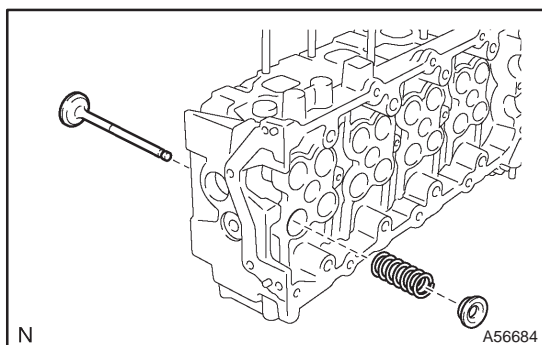
- (a) Apply seal packing to the semi-circular plug grooves.  
**Seal packing: Part No. 08826 – 00080 or equivalent**
- (b) Install the semi-circular plug to the cylinder head.

**33. INSTALL VALVE SPRING SEAT PLATE WASHER**



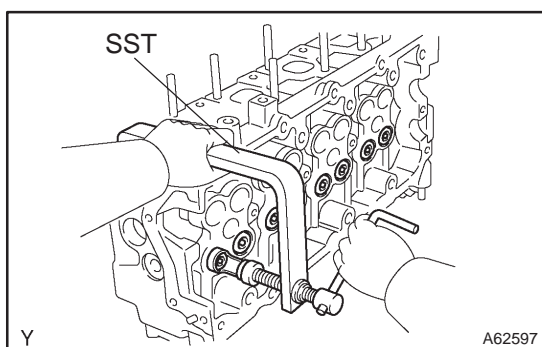
### 34. INSTALL VALVE STEM OIL O SEAL OR RING

- (a) Apply a light coat of engine oil on the valve stem.
- (b) Install a new oil seal on the valve guide bushing.

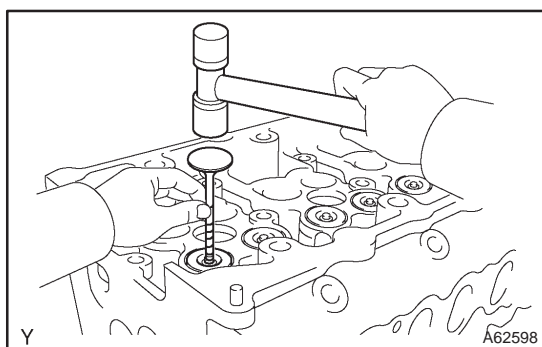


### 35. INSTALL INTAKE VALVE

- (a) Install the valve, valve spring, and spring retainer.



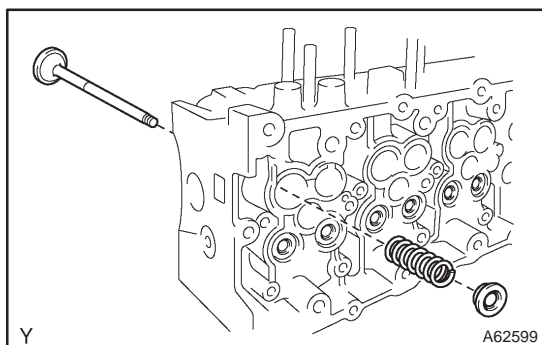
- (b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.  
SST 09202-70020 (09202-00010)



- (c) Using a plastic-faced hammer and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to ensure a proper fit.

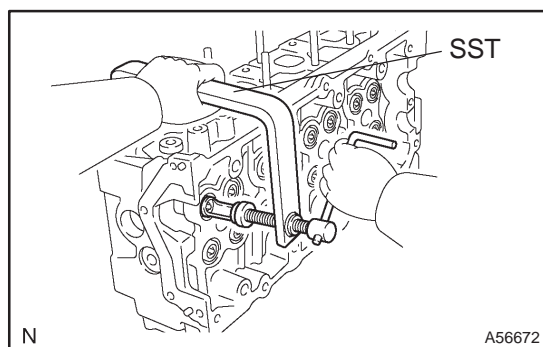
#### NOTICE:

**Be careful not to damage the valve stem tip.**

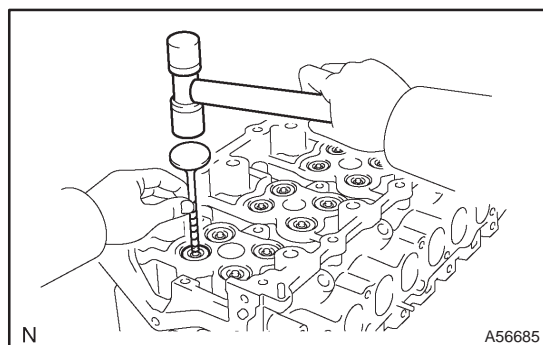


### 36. INSTALL EXHAUST VALVE

- (a) Install the valve, valve spring, and spring retainer.



- (b) Using SST, compress the valve spring and place the 2 keepers around the valve stem.  
SST 09202-70020 (09202-00010)



- (c) Using a plastic-faced hammer and the valve stem (not in use) tip wound with vinyl tape, lightly tap the valve stem tip to assure proper fit.

**NOTICE:**

**Be careful not to damage the valve stem tip.**